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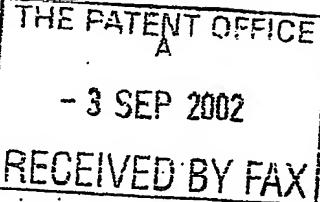
*D. Evans.*

Dated 25 November 2003

## Patents Form 1/77

Patents Act 1977  
(Rule 16)03SEP02 E745479-2 D02835  
P01/7700 0.00-0220447.7

## Request for grant of a patent

*(See the notes on the back of this form. You can also get an explanatory letter from the Patent Office to help you fill in this form.)*

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The Patent Office  
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1. Your reference

WMO/JAW/P200353

2. Patent application number

(The Patent Office will fill in this part)

0220447.7

03 SEP 2002

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)Lee, Paul Bernard  
P O Box 30576  
Dubai  
United Arab EmiratesPatents ADP number (*if you know it*)

6826991002

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

Ball operated by-pass tool for use in drillstring

5. Name of your agent (*if you have one*)

Urquhart-Dykes &amp; Lord

"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)Tower House  
Merrion Way  
Leeds  
LS2 8PA

1644074

Patents ADP number (*if you know it*)6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application number

Country

Priority application number  
(*if you know it*)Date of filing  
(*day / month / year*)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(*day / month / year*)8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (*Answer 'Yes' if*

No

- a) *any applicant named in part 3 is not an inventor, or*
- b) *there is an inventor who is not named as an applicant, or*
- c) *any named applicant is a corporate body.*

*See note (d))*

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9. Enter the number of sheets for any of the following items you are filing with this form.  
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Continuation sheets of this form

Description

4 ✓

Claim(s)

Wn

Abstract

Drawing(s)

2 ✓

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right  
to grant of a patent (Patents Form 7/77)Request for preliminary examination  
and search (Patents Form 9/77)Request for substantive examination  
(Patents Form 10/77)Any other documents  
(please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Date

*Urguhart-Dykes-ahard* 3-9-02

W M Orr - 0113 2452388

12. Name and daytime telephone number of person to contact in the United Kingdom

## Warning

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## BALL OPERATED BY-PASS TOOL FOR USE IN DRILLSTRING

This invention relates to a ball operated by-pass tool for use in a drillstring.

During drilling for underground fluids e.g. water, oil and gas, it is usual to employ a drillstring which has a rotatable drill bit at its lower end to drill through rock formations, and for extra lengths of drill pipe to be added at the surface as drilling proceeds.

During drilling operations, it is usually necessary to interrupt operations from time to time, in order to deal with hole drilling problems as they arise, and the present invention has been developed primarily with a view to providing an improved tool for "tripping" the operation of a drillstring when required.

The invention relies upon use of surface launched tool-activating balls which travel down the drillstring and which make contact with the tool (which is incorporated within the drillstring) so as to initiate by-pass action and allow for tripping the operation of the drillstring.

Examples of use of surface-launched tool activating balls are disclosed in more detail in US patent 4889199 and 5499687, and to which reference is directed for a fuller disclosure of the construction and operation of the tools and their activation in a by-pass mode, and subsequent reversion to inactive mode of allowing continued flow of fluids lengthwise of the drillstring.

According to the invention there is provided a by-pass tool for incorporation in a drillstring, and which has an inactive mode in which it allows fluid flow lengthwise of the drillstring during normal drilling operations, and which can be activated to an active by-pass mode when drilling is to be interrupted, said tool comprising:

An axially displaceable sleeve;

a valve seat provided in the sleeve and arranged to receive an activation ball, when the latter is launched from the surface and down the drillstring, said valve seat being operative to displace the sleeve and thereby initiate adjustment of the tool from the inactive mode to the active by-pass mode; and,

a by-pass port arranged to be closed by the sleeve when the tool is in its inactive mode and to be opened to the interior of the drillstring when the tool is in its active mode, said by-pass port being arranged above the valve seat so as to allow a locking ball (when launched from the surface after the valve seat has received the activating ball) to enter the

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port and thereby initiate flushing-out via the port of any drillstring debris above the valve seat.

A by-pass tool according to the invention therefore allows for safer and more timely tripping of a drillstring. By locking the port in the open condition of the tool, the drillstring can easily drain and fill during tripping operations.

The by-pass system provided by the tool of the invention may allow operators the ability to open and close the tool "down hole", and typically up to six times in order to deal with hole conditions. The new system can be safe, reliable and effective.

Preferably, in order to reset the tool, it is arranged so as to be capable of reacting to the launching of a second hard ball e.g. a steel deactivation ball, which closes the port or ports, and allows drilling to resume.

A preferred embodiment of by-pass tool according to the invention will now be described in detail, by way of example only, with reference to the accompanying drawing, in which:

Figure 1 is a side view illustrating the incorporation of a by-pass tool according to the invention in a drillstring, and in its inactive mode, allowing throughflow of fluids lengthwise of the drillstring;

Figure 2 is a detail view, to an enlarged scale, showing the self-adjustment of a valve seat of the tool, when it receives an activation ball launched from the surface, so as to adjust the tool to its active by-pass mode; and,

Figure 3 shows, through stages 1, 2, 3 and 4, successive phases of operation of the tool, when it adjusts itself between its inactive and active modes.

Referring now to the drawings, a by-pass tool according to the invention is designated generally by reference 10 and is intended to be incorporated in a drillstring 11, the tool having an inactive mode, as shown in Figure 1, in which it allows fluid flow lengthwise of the drillstring during normal drilling operations. However, the tool 10 can be activated to an active by-pass mode when drilling is to be interrupted, so that tripping operations can take place.

The tool comprises an axially displaceable sleeve 12, biassed by compression spring 13 to an inactive mode, but which is capable of being displaced against the action of the spring 13 when an activation ball is launched from the surface.

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A valve seat 14 is arranged within the sleeve 12 and can receive a large (deformable) activation ball 15, when the latter is launched from the surface and down the drillstring in order to activate the tool to the active mode. The valve seat 14 is movable downwardly when engaged by the ball 15, and then applies downward movement to the sleeve 12 and thereby expose or open at least one by-pass port 16.

The by-pass port 16 is therefore closed by the sleeve 12, when the tool 10 is in its inactive mode, and is opened and exposed to the interior of the drillstring when the tool is in its active mode.

The subsequent launching of a locking ball 17 from the surface enters by-pass port 16, and thereby initiates flushing-out via the port of any drillstring debris above the valve seat 14. Thus, with the activation ball 15 dropped, and the tool held open, the locking ball 17 moves through the port 16 in the sleeve 12 and lodged in the nozzle provided on the main body. The ball will then land in the nozzle, so that when pressure / flow is reduced, the sleeve will move back, pushing the ball against the nozzle and holding the sleeve open. The activation ball 15 remains on the valve seat, so that no debris can be accumulated above it, and all such debris is simply flushed out of the port (see Figure 1).

The following applications may be carried out, utilising the by-pass system disclosed herein:

- (a) pump LCM;
- (b) increase flow rates;
- (c) pump acid;
- (d) jet riser, Bops.

Advantages to the use of the system are:

- (a) fill pipe;
- (b) drain pipe;
- (c) equalise or reverse circulate for controlling fluid density;
- (d) "shocking" the pipe to remove scale or debris in the drillstring.

Thus, by locking the tool open and dropping one deactivation ball, the system will pressure up and shear the locking ball, thereby "shocking" the pipe, so that all debris will exit out of the port. Then the second deactivation ball can be dropped, in order to reset the tool and resume drilling.

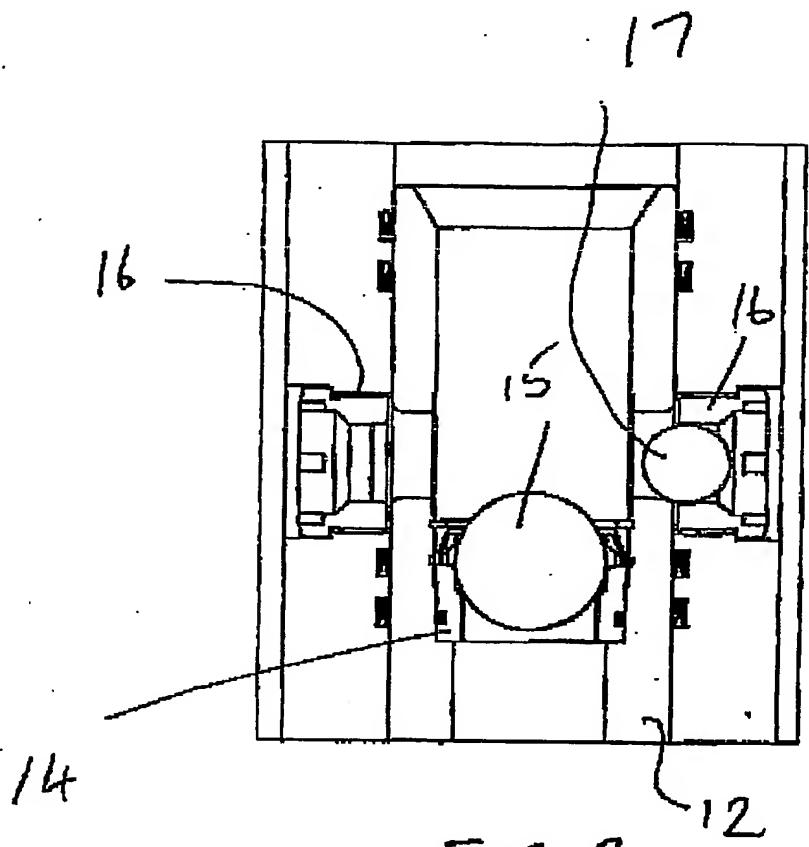
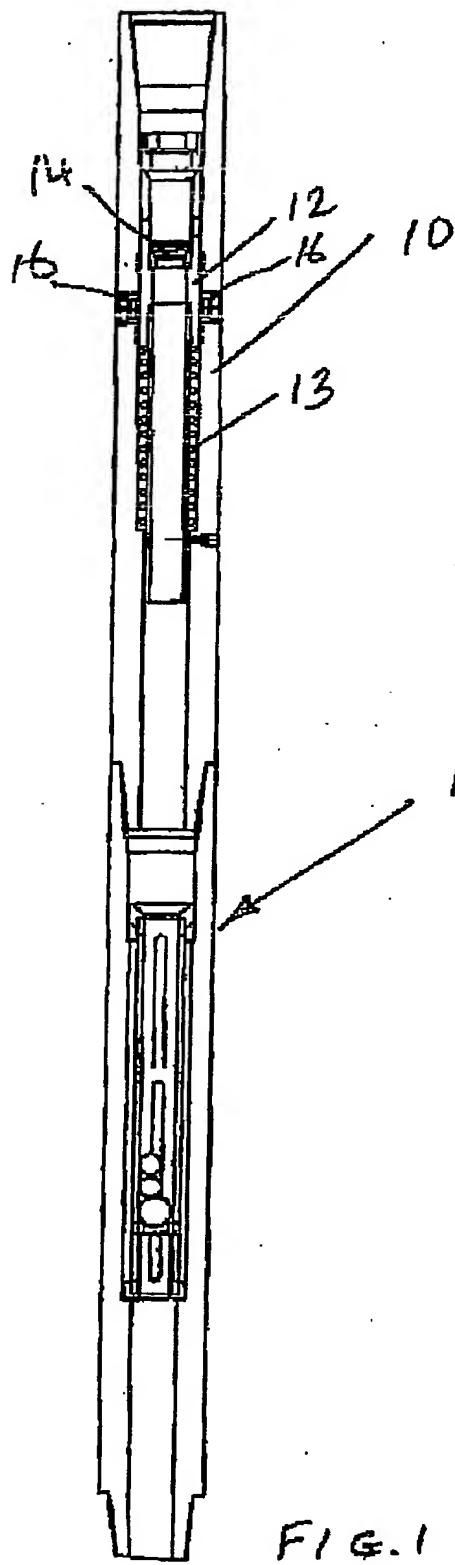
-4-

The design of the tool so as to be ball activated provides a simple system which allows the tool to be opened and closed "down hole" from the surface.

Figure 3 shows successive stages 1, 2, 3 and 4, involving launching of activation ball 15, and locking or deactivating balls 17, 18. In particular, stage 4 shows how (deformable) activation ball 15 can be forced downwardly through the valve seat 14, and downwardly through the drillstring, followed by the deactivation balls 17, 18.

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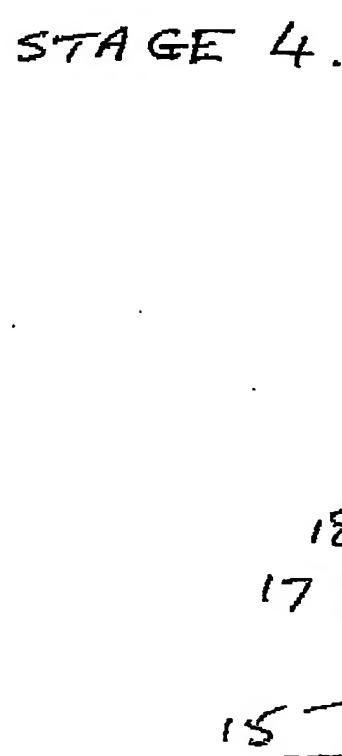
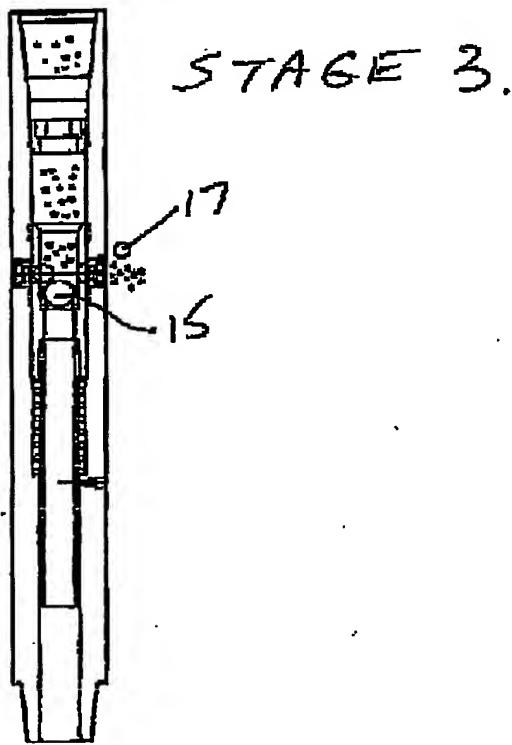
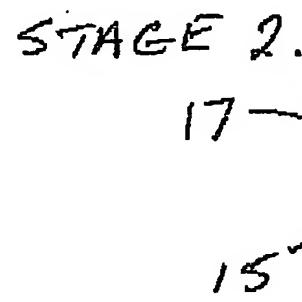
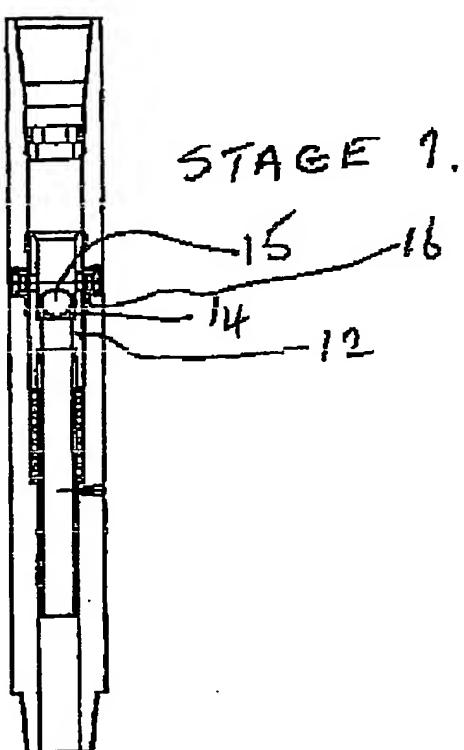


FIG. 3